

S
14.GS:
CIR 435
c.3

STATE OF ILLINOIS

DEPARTMENT OF REGISTRATION AND EDUCATION



MINERAL PRODUCTION IN ILLINOIS IN 1967

W. L. Busch

ILLINOIS STATE GEOLOGICAL SURVEY
LIBRARY
JAN 11 1968

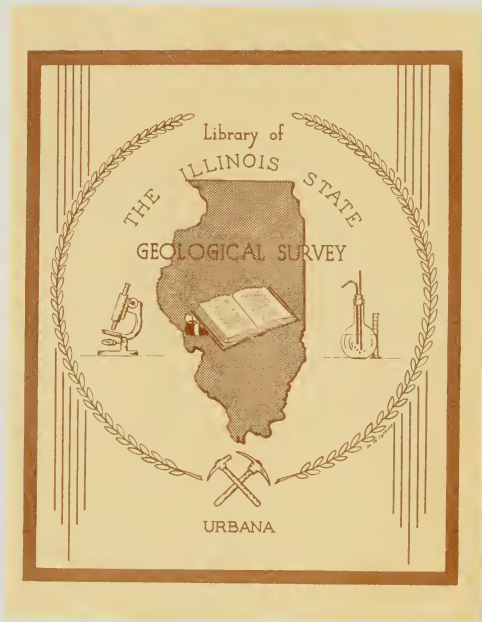
ILLINOIS STATE GEOLOGICAL SURVEY

John C. Frye, *Chief*

URBANA

CIRCULAR 435

1968



ILLINOIS STATE GEOLOGICAL SURVEY
3 3051 00003 6271

MINERAL PRODUCTION IN ILLINOIS IN 1967

W. L. Busch

ABSTRACT

The value of minerals reported produced in Illinois for 1967 totaled 650 million dollars. This was the highest annual value ever recorded for mineral production in the state and exceeded by 6 million dollars the former all-time high value of 644 million dollars set in 1966. The wide range of economic activity carried on in Illinois and neighboring states consumes large quantities of various mineral materials. The information recorded in the tables and maps of this report summarizes the amounts and values of fuels, building and construction materials, and minerals for specialized industries that were produced in Illinois during 1967.

ILLINOIS MINERAL INDUSTRY

Illinois is one of the foremost mineral-rich states of the nation, producing a variety of minerals from its many mines, pits, quarries, and wells. The total annual value of the minerals produced has been in excess of 600 million dollars for each year from 1956 through 1967.

The mineral resources of Illinois provide the basis for a wide range of economic activity. This report records the magnitude of the Illinois mineral industry, which in 1967 established a new all-time high value of 650 million dollars. The previous high value for mineral production in the state was set in 1966 when 644 million dollars worth of mineral products were produced.

Coal and oil, the two minerals leading in value from year to year, accounted for about two-thirds of the state's entire mineral value in 1967. An abundance of industrial minerals, such as sand, gravel, stone, and cement- and lime-making materials, furnish supplies for the construction industries. Minerals for special purposes, such as refractory clays and clays for pottery making and silica sand for

glass and many other special uses, are produced in large quantities. Illinois is the leading producer of fluorspar, a mineral important in the steel, chemical, and ceramics industries. Also produced in Illinois are tripoli, natural bonded molding sand, sandstone, and the metals zinc and lead.

Record of the Illinois Mineral Industry

Each of the 17 tables and 3 maps shown in this report is described briefly under the following table numbers and titles.

Table 1 - Summary of Illinois Mineral Production, 1966-1967

Table 1, the master table of this report, gives a statistical summary of Illinois mineral production for the years 1966 and 1967. Listed are the various minerals produced, the reported amounts produced by commercial operators, the total annual value for each product, and the state-wide average value per ton or barrel for all products listed for both years. Given under footnote "c" are the names of other mineral products produced in Illinois. However, in order to avoid revealing the output of any individual producer of these items, their combined values were added to the state total value in one figure.

Improved streets and highways, additional housing, stores and other commercial buildings, schools, recreational facilities, churches, hospitals, and other community projects require substantial quantities of Illinois mineral construction materials annually. Table 1 and other tables in this report indicate the amounts and values of such construction materials produced in 1967.

Table 2 - Illinois Mineral Production in 1966 and 1967 Compared

Although the state's ever-expanding demand for energy and materials has resulted in the use of large quantities of Illinois fuels and other mineral products each year over a period of years, the production of individual mineral products does not necessarily increase (or decrease) every year.

Table 2 lists all of the mineral products shown in table 1 and indicates by the amounts and values that the 1967 production was greater, or less than, the 1966 production of each mineral product. The balance of declines and increases in value for the individual mineral products shows a net gain of 6 million dollars, or 0.9 per cent, for the 1967 state total value over the 1966 state total value.

Table 3 - Value of Illinois Mineral Production, 1944-1967

Illinois annual mineral production value totals in table 3 show a definite upward trend. Gradual price increases, from 1944 to 1967, for many mineral commodities produced in Illinois cannot alone account for the increasing total values for the state. A general increase in mineral production throughout the state during the 24 years, plus the increases in price, per ton or barrel, brought about the greater total annual values for the state. The growing amounts of minerals produced annually in Illinois, over a period of time, confirm the abundant mineral resources that the state possesses.

Table 4 - Percentage of Total Value Contributed by Various Segments of the Illinois Mineral Industry, 1955-1967

The percentage figures in table 4 show several immediate facts concerning the Illinois mineral industry. The total value of coal has increased almost 10 per-

centage points during a time of rising annual total values for the state, from 1955 through 1967. During the same period, the total value of oil has decreased almost 15 percentage points in the total value of all minerals produced in the state.

Table 4 also indicates that the building and construction materials (stone products, sand and gravel) have been accounting for an increasing percentage of the state's total annual value of mineral products. This suggests the general availability of these materials and that their production has met the apparent demand. The value contributed annually by clay products to the state total value, from 1955 through 1967, shows a gradual decline percentagewise. The annual value of fluorspar, zinc, and lead, as a percentage of the state total value, has not varied much from year to year.

Table 5 - Average Value of Illinois Mineral Products at Plant Site, 1961-1967

Table 5 shows only a brief history of the plant site values of Illinois mineral products, and most of the figures listed represent a price plateau, which has been attained after gradual price increases occurring over a period of about 25 years prior to 1967. However, the prices per barrel, or per ton, recorded in this table give some indication of recent plant site values for Illinois mineral products.

Table 6 - Illinois Coal Production by Counties, 1967

The information presented in table 6, a specialized table, shows in some detail the production of coal in Illinois for 1967. Twenty-five counties throughout the state produced a total of about 64.8 million tons of bituminous coal, valued at about 251.5 million dollars. The value of coal produced represents almost 39 percent of the entire 1967 Illinois mineral product value. Of the 64.8 million tons of coal mined during 1967, approximately 43 percent of the total came from underground mines, and about 57 percent was produced by Illinois strip mines.

Twelve counties, out of the 25 producing coal in 1967, had a production of over 1 million tons each. Perry County was the state's leading coal producer, with about 9.3 million tons. Fulton County was in second place, with a production of about 8.0 million tons, and Franklin County was in third place, with about 7.6 million tons. Table 17 of this report shows the position held by each county producing coal in 1967. Table 4 indicates the annual percentage that the value of coal contributed to the state total value of all minerals produced each year, from 1955 through 1967. Table 5 lists the Illinois average value per ton of coal at the mine from 1961 through 1967. The 25 counties of Illinois that produced coal in 1967 are indicated by the county map in figure 1, with the intensity of mining activity illustrated by the degree of shading.

Table 7 - Illinois Coal Production by Years, 1833-1881

Table 7 shows the amount of coal estimated to have been produced in Illinois for each year, from 1833 through 1881. The indicated amount of coal produced during this 49-year period totals 73,386,123 tons. As a part of table 8, this tonnage figure is tabulated under the heading "Estimated production (1833-1881)." Special attention is directed toward table 7, because this is the first time that these coal production figures have been published in the present series of annual reports concerning mineral production in Illinois.

Table 8 - Coal Production by Illinois Counties, 1882-1967

The cumulative coal production by Illinois counties, since 1882, is shown in table 8. During this period of 86 years, almost 4 billion tons of coal have been

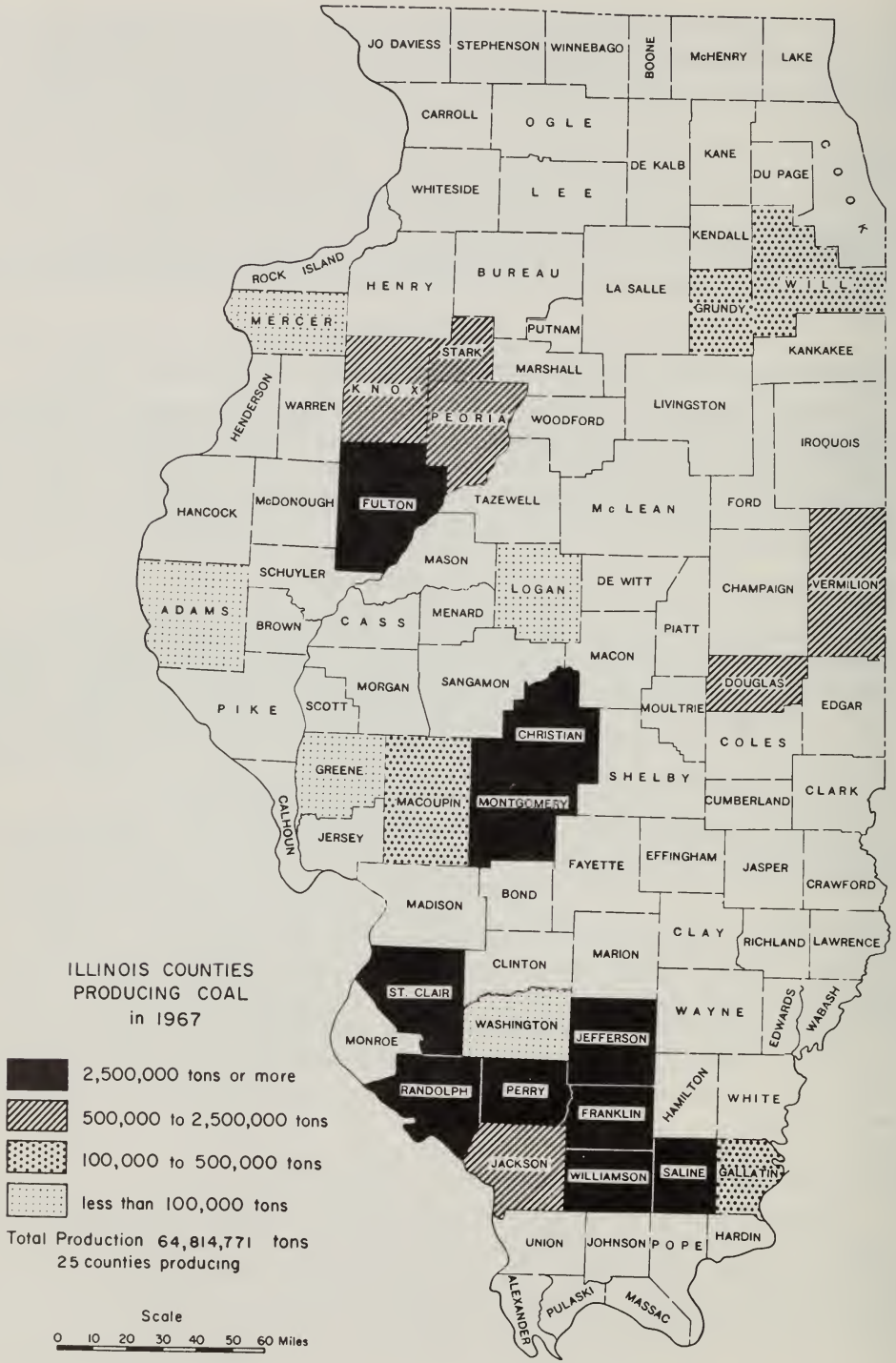


Figure 1 - Illinois coal production by counties in 1967.

produced from Illinois mines. However, the over-all Illinois coal production, from 1833 through 1967, totals about 4.1 billion tons. Of the 71 counties that have a record of some coal production since 1882, 12 counties have produced more than 100 million tons of coal each. As a group, these counties have accounted for a total production of about 3.1 billion tons, or about 78.2 percent of the state's entire coal output since 1882. Table 8 also shows the total number of years that each county has produced coal since 1882 and the most recent year it was productive.

Table 9 - Estimated Oil Production by Illinois Counties, 1888-1967

Production of crude oil from Illinois wells in 1967 was estimated at about 60.1 million barrels. The total value of Illinois crude oil produced during 1967 amounted to about 181.5 million dollars, for an average price of \$3.02 per barrel.

The estimated amount and value of oil produced by county in 1967 is given in table 9 along with the percentage of oil that each producing county supplied to the 1967 total Illinois production. The total estimated oil production from 1888 through 1967 is indicated by figures for each county in table 9. Figure 2 shows the 42 counties in Illinois that produced oil in 1967 and indicates the major oil-producing areas. Of the 42 counties producing oil in 1967, 14 counties produced more than 1 million barrels each for a total of about 53.2 million barrels, or about 88.6 percent of the state's entire oil production for 1967.

Table 9 shows that Fayette County was the state's leading oil producer, with a production of about 7.5 million barrels in 1967. Lawrence County was in second place, with a production of about 6.8 million barrels, and White County was in third place, with about 6.2 million barrels. Table 17 of this report shows the position held by each county producing oil in 1967. Table 4 indicates the annual percentage that the value of oil contributed to the state total value of all minerals produced each year from 1955 through 1967. Table 5 lists the Illinois average price per barrel of oil from 1961 through 1967.

Table 10 - Illinois Stone Production by Regions, 1967

According to table 10, a production of 44.8 million tons of crushed and broken stone was reported by commercial quarry operators for 1967. This prepared stone was valued at 63.1 million dollars for an average of \$1.41 per ton. The tonnage produced in 1967, from 227 operations located in 60 counties throughout the state, was about 2.2 million tons more than the 1966 stone production, which amounted to 42.6 million tons.

A detailed account of stone production in Illinois according to region (fig. 3) and according to three categories of use—road and building, agriculture, and all other uses—is given in table 10. Table 10 also lists every county reporting stone production and the average value at the quarry for all uses of stone in all regions for 1967. The value of crushed stone produced in 1967, plus the values of the stone products cement and lime, contributed about 16.9 percent (table 4) of the total Illinois mineral value for that year.

In 1967, 10 Illinois counties—Cook, Will, Kankakee, St. Clair, Livingston, Rock Island, Hardin, Randolph, DuPage, and Montgomery—produced 29.1 million tons of crushed and broken stone, or about 64.9 percent of the state's total stone output. Table 5 gives the yearly average value per ton of stone at the quarry from 1961 through 1967. Table 17 of this report shows the position held by each county producing stone in 1967.

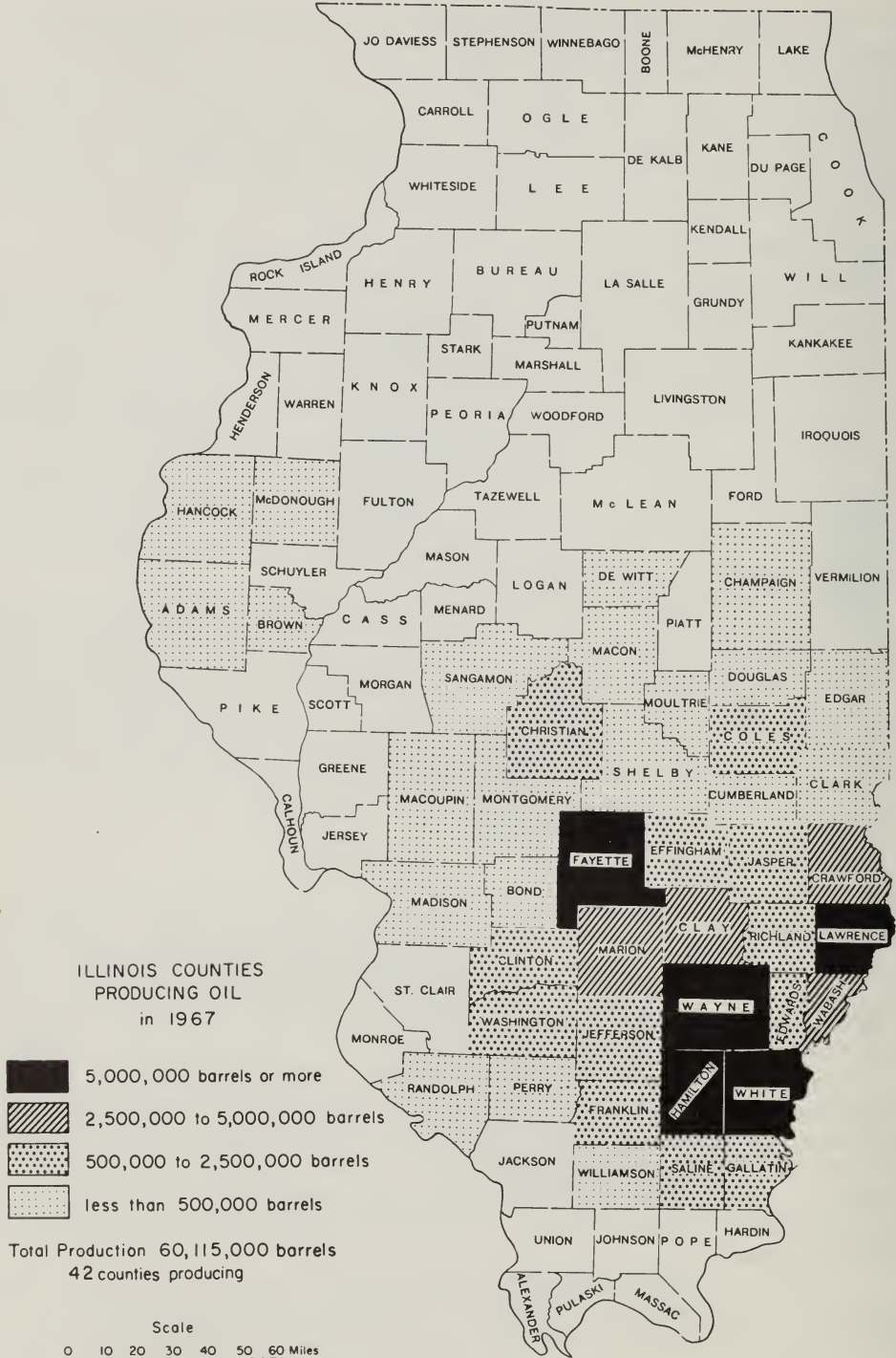


Figure 2 - Illinois oil production by counties in 1967.



Figure 3 - County outline map of Illinois showing area division.

Table 11 - Illinois Common Sand Production by Regions, 1967

Table 12 - Illinois Gravel Production by Regions, 1967

Common sand and gravel are used extensively in Illinois for various building and construction purposes. In 1967, a total production of 33.5 million tons of sand and gravel was reported produced by commercial operators. The combined total value of these materials amounted to about 30.4 million dollars.

Counties in the Northeast Region of the state (fig. 3) produced the largest amounts of sand and gravel in 1967. (Figure 3, a county outline map of Illinois, shows the regional divisions of the state used in constructing tables 11 and 12.) As a group, the 11 counties in the Northeast Region produced 18.5 million tons of sand and gravel, which was valued at about 16.1 million dollars. The second most important area for the production of common sand and gravel is the Northwest Region. In 1967, the 12 counties in this part of Illinois produced about 5.5 million tons of sand and gravel valued at about 4.5 million dollars. The Central Region, in third place, produced 4.1 million tons of sand and gravel, worth 4.4 million dollars.

McHenry County was first among all counties in Illinois in the production of both sand and gravel in 1967. The southern part of Illinois has comparatively few sand and gravel producing areas, with the exception of some counties that border on the Mississippi, Ohio, or Wabash Rivers. Table 17 of this report lists the numerical position that each Illinois county held, among all counties of the state, in the production of common sand and gravel in 1967.

Table 13 - Illinois Silica Sand Production, 1966-1967

A special sand produced in Illinois is silica sand. This sand, which is produced primarily in LaSalle County and in smaller amounts in Ogle County, has many important industrial uses. Table 13 indicates that in 1966 and 1967 the most important use for Illinois silica sand, in tons of material used, was for the manufacture of glass. The second most important use for this material, in terms of tons used in 1966 and 1967, was for molding sand purposes. Other uses for unground silica sand include grinding, blast, engine, filtration, and oil sand. Ground silica sand has many other important roles, which include abrasive, chemical, enamel, filler, foundry, glass, pottery, and other uses. -

During 1966 and 1967, Illinois silica sand operators produced a total of about 3.8 million tons of this material each year. In 1966, the silica sand produced was valued at 13.1 million dollars, and in 1967 the value of the product amounted to about 12.9 million dollars. The total value of all sands and gravel produced in Illinois during 1967 amounted to 6.8 percent of the value of all minerals produced in the state (table 4). Table 5 indicates the average annual value, from 1961 through 1967, of various Illinois mineral products, including common sand and gravel and silica sand.

Table 14 - Production of Illinois Clay Products, 1966-1967

Illinois clay products include such items as face brick and common brick, sewer pipe and drain tile, building tile, vitreous plumbing fixtures, electrical porcelains, pottery and whiteware, lightweight aggregates, and clay and silica refractories. The value of clay products reported produced in Illinois during 1966 was 54.9 million dollars, and for 1967, 46.1 million dollars.

In 1966, 45 clay products plants, located in 26 counties throughout Illinois, reported production; in 1967, 41 plants, located in 24 counties, reported production.

In 1967, the total value of clay products produced was about 7.1 percent of the value of all minerals produced in the state.

LaSalle County was the top-ranking county in the state in the reported production of various clay products during 1966 and 1967. McDonough County was second, Cook County was third, Knox County was fourth, and Will County was fifth in the 1967 production of Illinois clay products. During 1967, the five counties named above supplied about 61.8 percent of the value of all clay products produced in the state. The rank of all counties in the state reporting the production of clay products for 1967 is given in table 17 of this report.

Table 15 - Fluorspar Shipped and Consumed, 1960-1967

Production figures indicate that Illinois fluorspar producers shipped a total of 210,207 tons of this mineral in 1967, which was valued at about 9.9 million dollars, for an average price of \$46.90 per ton (table 5). Table 15 shows that Illinois fluorspar shipments during 1967 amounted to about 71.1 percent of all fluorspar produced and shipped in the United States. Of the 1.1 million tons of domestic and foreign fluorspar consumed in the United States during 1967, Illinois fluorspar shipments supplied about 19.3 percent of this total.

Illinois is the nation's foremost fluorspar producing state and supplies this material for use in the iron and steel, aluminum, chemical, glass, and ceramics industries. Fluorspar was mined principally in Hardin County, with small amounts produced in Pope County. Both counties are located in the extreme southern part of Illinois.

Table 16 - Illinois Zinc and Lead Production, 1960-1967

Zinc and lead, the two metals produced in Illinois, are recovered from primary metal mines in Jo Daviess County, located in the northwestern part of the state, and as by-products of fluorspar mining in Hardin and Pope Counties, in the southern part of Illinois.

Production figures in table 16 show that during 1967 Illinois mines produced 20,416 tons of zinc, valued at 5.6 million dollars, and 2384 tons of lead, valued at \$667,520. The combined values of fluorspar shipments and the values of zinc and lead produced in Illinois contributed about 2.5 percent (table 4) of the state's 1967 total mineral products value of 650 million dollars.

Table 17 - Summary of Minerals Produced by Illinois Counties, 1967

Table 17 of this report is a convenient reference to the counties in Illinois producing any 1 of 14 mineral products of this state. The table indicates the different mineral products produced by any county in the state, and the numbers show the position held by each county among all counties producing a selected mineral product.

TABLE 1 - SUMMARY OF ILLINOIS MINERAL PRODUCTION, 1966-1967^a

Material	Unit	1966 ^b			1967 ^b		
		Quantity	Value at plants		Quantity	Value at plants	
			Total	Average		Total	Average
Coal - bituminous	tons	63,212,697	\$243,368,883	\$ 3.85	64,814,771	\$251,481,312	\$ 3.88
Crude oil	bbls.	61,982,000	185,946,000	3.00	60,115,000	181,547,300	3.02
Limestone and dolomite	tons	42,579,368	57,412,100	1.35	44,836,956	63,116,345	1.41
Cement - Portland 376 lb.	bbls.	9,203,150	28,617,379	3.11	9,068,892	30,185,632	3.33
Cement - Masonry 280 lb.	bbls.	614,321	1,868,016	3.04	591,153	1,850,650	3.13
Clay products	—	—	54,901,990	—	—	46,114,642	—
Sand	tons	14,371,000	12,139,000	0.84	15,562,000	13,183,000	0.85
Gravel	tons	19,027,000	17,296,000	0.91	17,946,000	17,191,000	0.96
Silica sand	tons	3,853,000	13,145,000	3.41	3,825,000	12,895,000	3.37
Fluorspar	tons	176,175	8,001,803	45.42	210,207	9,858,743	46.90
Zinc	tons	15,192	4,405,680	290.00	20,416	5,652,374	277.00
Lead	tons	2,285	690,756	302.00	2,384	667,520	280.00
Other materials ^c	—	—	16,207,393	—	—	16,256,482	—
Total value			\$644,000,000			\$650,000,000	

^aTable based on figures from the U.S. Bureau of Mines, the Illinois State Department of Mines and Minerals, and the Illinois State Geological Survey.

^bSubject to revision.

^cIncludes natural gas, lime, tripoli, natural bonded molding sand, and sandstone.

TABLE 2 - ILLINOIS MINERAL PRODUCTION IN 1966 and 1967 COMPARED^a

Material	Unit	Production change 1966-1967			Value change 1966-1967		
		Increase	Decrease	Percent	Increase	Decrease	Percent
Coal - bituminous	tons	1,602,074	—	+ 2.5	\$8,112,429	\$ —	+ 3.3
Crude oil	bbls.	—	1,867,000	- 3.0	—	4,398,700	- 2.4
Limestone and dolomite	tons	2,257,588	—	+ 5.3	5,704,245	—	+ 9.9
Cement - Portland 376 lb.	bbls.	—	134,258	- 1.5	1,568,253	—	+ 5.5
Cement - Masonry 280 lb.	bbls.	—	23,168	- 3.8	—	17,366	- 0.9
Clay products	—	—	—	—	—	8,787,348	- 16.0
Sand	tons	1,191,000	—	+ 8.3	1,044,000	—	+ 8.6
Gravel	tons	—	1,081,000	- 5.7	—	105,000	- 0.6
Silica sand	tons	—	28,000	- 0.7	—	250,000	- 1.9
Fluorspar	tons	34,032	—	+ 19.3	1,856,940	—	+ 23.2
Zinc	tons	5,224	—	+ 34.4	1,246,694	—	+ 28.3
Lead	tons	99	—	+ 4.3	—	23,236	- 3.4
Other materials	—	—	—	—	49,089	—	+ 0.3
Total values					\$19,581,650	\$13,581,650	—
1967 Net increase in value over 1966 value					\$ 6,000,000	—	+ 0.9

^aTable 2 based on figures tabulated in table 1.

TABLE 3 - VALUE OF ILLINOIS MINERAL PRODUCTION, 1944-1967
(thousands of dollars)

Year	Mineral production	Year	Mineral production	Year	Mineral production
1944	\$342,832	1952	\$500,820	1960	\$615,800
1945	344,431	1953	501,926	1961	604,000
1946	379,673	1954	519,242	1962	631,000
1947	458,737	1955	570,653	1963	615,000
1948	567,624	1956	613,364	1964	618,000
1949	487,808	1957	612,755	1965	618,500
1950	539,236	1958	611,625	1966	644,000
1951	542,031	1959	606,300	1967	650,000

TABLE 4 - PERCENTAGE OF TOTAL VALUE CONTRIBUTED BY VARIOUS SEGMENTS
OF THE ILLINOIS MINERAL INDUSTRY, 1955-1967

Year	Coal	Petroleum products	Stone products	Clay products	Sand and gravel	Fluorspar and metals	Total percent
1955	29.3	42.7	11.3	9.6	4.5	2.6	100
1956	30.0	40.6	12.2	9.6	5.0	2.6	100
1957	30.5	40.1	12.3	9.9	4.8	2.4	100
1958	28.7	40.5	13.7	9.0	5.8	2.3	100
1959	30.4	38.7	13.7	9.6	5.5	2.1	100
1960	29.8	38.0	15.0	9.2	5.5	2.5	100
1961	29.2	39.1	14.5	9.3	5.8	2.1	100
1962	29.6	38.0	15.2	8.9	6.2	2.1	100
1963	31.9	36.3	15.2	8.8	5.9	1.9	100
1964	33.6	33.5	16.4	8.3	6.5	1.7	100
1965	35.2	30.3	17.1	8.5	6.6	2.3	100
1966	37.8	29.0	16.0	8.5	6.7	2.0	100
1967	38.7	28.0	16.9	7.1	6.8	2.5	100

TABLE 5 - AVERAGE VALUE OF ILLINOIS MINERAL PRODUCTS
AT PLANT SITE, 1961-1967

Year	Coal (ton)	Crude oil (bbl.)	Crushed stone (ton)	Cement (bbl.)	Lime (ton)	Silica sand (ton)
1961	\$3.91	\$3.00	\$1.37	\$3.28	\$16.31	\$3.69
1962	3.86	3.00	1.36	3.29	16.29	3.96
1963	3.80	2.96	1.33	3.28	16.51	3.61
1964	3.79	2.93	1.35	3.30	16.61	3.27
1965	3.74	2.93	1.34	3.26	15.73	3.30
1966	3.85	3.00	1.35	3.11	15.53	3.41
1967	3.88	3.02	1.41	3.32	15.38	3.37

Year	Sand (ton)	Gravel (ton)	Fluorspar (ton)	Zinc (ton)	Lead (ton)	Tripoli (ton)
1961	\$0.88	\$0.89	\$50.95	\$230.00	\$206.00	\$25.02
1962	0.86	0.93	48.12	230.00	184.00	26.13
1963	0.85	0.97	49.58	230.00	216.00	26.90
1964	0.87	1.01	50.62	272.00	262.00	26.88
1965	0.85	0.91	49.40	292.00	312.00	26.59
1966	0.84	0.91	45.42	290.00	302.00	26.56
1967	0.85	0.96	46.90	277.00	280.00	31.03

TABLE 6 - ILLINOIS COAL PRODUCTION BY COUNTIES, 1967^a

County	Number of mines	Tons mined		Total tons	Total value ^b
		Underground	Strip		
Adams	1	—	16,334	16,334	\$ 63,376
Christian	1	5,700,014	—	5,700,014	22,116,054
Douglas	1	745,786	—	745,786	2,893,650
Franklin	4	7,577,422	—	7,577,422	29,400,397
Fulton	8	—	8,044,017	8,044,017	31,210,786
Gallatin	3	132,629	266,898	399,527	1,550,165
Greene	1	—	1,039	1,039	4,031
Jackson	5	—	715,390	715,390	2,775,713
Jefferson	2	3,031,159	—	3,031,159	11,760,897
Kankakee	1	—	753,756	753,756 ^c	2,924,573
Knox	2	—	1,248,924	1,248,924	4,845,825
Logan	1	18,880	—	18,880	73,255
Macoupin	1	416,049	—	416,049	1,614,270
Mercer	2	14,127	230	14,357	55,705
Montgomery	2	3,549,158	—	3,549,158	13,770,733
Peoria	5	2,987	1,474,845	1,477,832	5,733,988
Perry	3	—	9,321,683	9,321,683	36,168,130
Randolph	3	882,420	3,532,478	4,414,898	17,129,804
St. Clair	4	390,122	6,441,122	6,831,244	26,505,227
Saline	5	1,480,811	1,109,650	2,590,461	10,050,989
Stark	1	—	574,069	574,069	2,227,388
Vermilion	5	50,692	573,927	624,619	2,423,522
Washington	1	33,449	—	33,449	129,782
Williamson	15	3,624,295	3,090,409	6,714,704	26,053,052
Total	77	27,650,000	37,164,771	64,814,771	\$251,481,312

^aProduction figures, Illinois State Department of Mines and Minerals.

^bAverage mine value for Illinois coal estimated at \$3.88 per ton, 1967.

^cMine tippie located in Kankakee County—261,623 tons mined in Grundy County and 492,133 tons mined in Will County.

TABLE 7 - ILLINOIS COAL PRODUCTION BY YEARS, 1833-1881^a

Year	Tons	Year	Tons	Year	Tons
1833	6,000	1850	300,000	1867	1,800,000
1834	7,500	1851	320,000	1868	2,000,000
1835	8,000	1852	340,000	1869	1,854,000
1836	10,000	1853	375,000	1870	2,624,163
1837	12,500	1854	385,000	1871	3,000,000
1838	14,000	1855	400,000	1872	3,360,000
1839	15,038	1856	410,000	1873	3,920,000
1840	16,967	1857	450,000	1874	4,203,000
1841	35,000	1858	490,000	1875	4,453,178
1842	58,000	1859	530,000	1876	5,000,000
1843	75,000	1860	728,400	1877	5,395,000
1844	120,000	1861	670,000	1878	5,700,000
1845	150,000	1862	780,000	1879	5,000,000
1846	165,000	1863	890,000	1880	6,115,377
1847	180,000	1864	1,000,000	1881	6,720,000
1848	200,000	1865	1,260,000		
1849	260,000	1866	1,580,000	Indicated total	73,386,123

^aSource: Illinois State Department of Mines and Minerals.

TABLE 8 - COAL PRODUCTION BY ILLINOIS COUNTIES, 1882-1967^a

County	Total production (tons)	Total years active	Last year active	County	Total production (tons)	Total years active	Last year active
Adams	325,962	24	1967	Marshall	12,516,141	70	1951
Bond	7,355,569	57	1942	Menard	13,462,005	84	1965
Brown	65,347	40	1963	Mercer	15,335,295	80	1967
Bureau	53,823,055	80	1964	Monroe	8,284	13	1941
Calhoun	96,247	27	1912	Montgomery	110,463,070	86	1967
Cass	212,477	53	1941	Morgan	190,787	64	1951
Christian	276,569,395	83	1967	Moultrie	2,032,236	16	1924
Clark	4,482	2	1955	Peoria	76,515,559	86	1967
Clay	801	1	1963	Perry	217,992,029	86	1967
Clinton	38,656,325	79	1960	Pike	5,081	8	1942
Coles	198,932	6	1888	Pope	1,562	11	1938
Crawford	45,400	16	1961	Putnam	10,071,893	29	1938
Douglas	8,016,452	22	1967	Randolph	97,567,969	86	1967
Edgar	915,698	41	1952	Richland	154	1	1890
Effingham	796	1	1890	Rock Island	3,846,169	67	1948
Franklin	535,848,194	69	1967	St. Clair	289,049,348	86	1967
Fulton	254,864,089	86	1967	Saline	225,775,447	86	1967
Gallatin	6,589,358	83	1967	Sangamon	233,449,607	83	1964
Greene	693,191	84	1967	Schuyler	7,747,691	84	1966
Grundy	42,895,251	84	1967	Scott	612,476	61	1942
Hamilton	22,097	16	1905	Shelby	4,119,763	67	1950
Hancock	771,281	72	1958	Stark	4,938,941	77	1967
Hardin	40	1	1890	Tazewell	17,633,802	75	1956
Henry	22,910,053	84	1965	Vermilion	163,120,089	86	1967
Jackson	96,788,084	86	1967	Wabash	198,226	36	1964
Jasper	23,739	11	1939	Warren	685,466	73	1954
Jefferson	47,297,719	64	1967	Washington	18,123,237	86	1967
Jersey	120,350	59	1951	White	1,676,741	36	1940
Johnson	245,942	53	1965	Will	41,224,515	86	1967
Kankakee	8,752,960	43	1962	Williamson	381,825,629	86	1967
Knox	49,823,557	86	1967	Woodford	7,810,160	70	1951
LaSalle	65,547,638	79	1960	Total (1882-1967)		3,990,517,970	
Livingston	10,111,437	80	1961	Estimated production (1833-1881)		73,386,123	
Logan	14,510,447	83	1967	Total production (1833-1967)		4,063,904,093	
Macon	11,000,468	65	1947				
Macoupin	265,693,229	86	1967				
McDonough	2,634,903	69	1951				
McLean	5,544,139	47	1928				
Madison	164,295,772	83	1964				
Marion	39,247,722	82	1963				

^aProduction figures, Illinois State Department of Mines and Minerals.

TABLE 9 - ESTIMATED OIL PRODUCTION BY ILLINOIS COUNTIES, 1888-1967^a

County	Total production 1888-1967 ^b	1967 production		1967 value ^c
		Thousands of barrels	Percent of state total	
Adams	161	2	—	\$ 6,040
Bond	6,806	109	0.18	329,180
Brown	211	3	—	9,060
Champaign	5	2	—	6,040
Christian	22,197	533	0.88	1,609,660
Clark-Cumberland	86,273	701	1.16	2,117,020
Clay	115,855	3,053	5.08	9,220,060
Clinton	77,936	926	1.54	2,796,520
Coles	20,376	557	0.92	1,682,140
Crawford	213,416	3,172	5.28	9,579,440
DeWitt	1,313	241	0.40	727,820
Douglas	3,308	93	0.15	280,860
Edgar	2,755	91	0.15	274,820
Edwards	40,844	880	1.46	2,657,600
Effingham	12,591	599	0.99	1,808,980
Fayette	352,779	7,530	12.55	22,740,600
Franklin	63,643	1,654	2.75	4,995,080
Gallatin	43,600	975	1.62	2,944,500
Hamilton	118,793	5,587	9.31	16,872,740
Hancock-McDonough	5,150	39	0.06	117,780
Jasper	43,181	1,450	2.41	4,379,000
Jefferson	73,142	1,612	2.68	4,868,240
Lawrence	349,887	6,791	11.30	20,508,820
Macon	841	12	0.02	36,240
Macoupin	218	4	—	12,080
Madison	16,191	216	0.36	652,320
Marion	375,810	4,859	8.09	14,674,180
Monroe	2	—	—	—
Montgomery	111	1	—	3,020
Moultrie	74	7	0.01	21,140
Perry	629	28	0.04	84,560
Randolph	3,560	109	0.18	329,180
Richland	88,325	1,914	3.19	5,780,280
St. Clair	2,883	—	—	—
Saline	17,022	1,108	1.84	3,346,160
Sangamon	1,382	115	0.19	347,300
Schuyler	1	—	—	—
Shelby	1,297	53	0.08	160,060
Wabash	93,887	2,640	4.40	7,972,800
Washington	24,259	533	0.88	1,609,660
Wayne	203,258	5,634	9.39	17,014,680
White	236,179	6,239	10.39	18,841,780
Williamson	576	43	0.07	129,860
Total	2,720,727	60,115	100.00	\$181,547,300

^aSubject to revision.^bIn thousands of barrels.^cAverage price estimated at \$3.02 per barrel.

TABLE 10 - ILLINOIS STONE PRODUCTION BY REGIONS, 1967^{a,b}

Producing counties and operations ^c		Stone use	Tons	Value	Average per ton
NORTHWEST					
Carroll	Ogle	Road and			
Henry	Rock Island	building	4,330,720	\$5,018,832	\$1.16
Jo Daviess	Stephenson	Agstone	346,894	486,648	1.40
Lee	Whiteside	All other	72,755	74,068	1.02
Mercer	Winneshago				
Operations - 95		Total	4,750,369	\$5,579,548	\$1.17
WEST					
Adams	Knox	Road and			
Brown	McDonough	building	1,472,291	\$2,051,397	\$1.39
Hancock	Schuyler	Agstone	375,836	606,250	1.61
Henderson	Warren	All other	389,144	864,046	2.22
Operations - 25		Total	2,237,271	\$3,521,693	\$1.57
WEST SOUTHWEST					
Calhoun	Madison	Road and			
Christian	Montgomery	building	2,087,398	\$3,372,676	\$1.62
Greene	Pike	Agstone	528,810	794,407	1.50
Jersey	Scott	All other	32,175	41,920	1.30
Operations - 26		Total	2,648,383	\$4,209,003	\$1.59
SOUTHWEST					
Clinton	Randolph	Road and			
Jackson	St. Clair	building	3,890,078	\$5,913,453	\$1.52
Johnson	Union	Agstone	666,547	1,005,915	1.51
Monroe	Washington	All other	1,485,429	1,929,762	1.30
Pulaski					
Operations - 21		Total	6,042,054	\$8,849,130	\$1.46
NORTHEAST					
Boone	Kendall	Road and			
Cook	LaSalle	building	18,819,525	\$25,163,211	\$1.34
DeKalb	McHenry	Agstone	343,728	528,372	1.54
DuPage	Will	All other	893,115	1,578,615	1.77
Kane					
Operations - 25		Total	20,056,368	\$27,270,198	\$1.36
EAST					
Kankakee		Road and			
Livingston		building	3,768,783	\$5,174,156	\$1.37
Vermilion		Agstone	732,751	1,038,282	1.42
Operations - 10		All other	242,277	467,278	1.93
		Total	4,743,811	\$6,679,716	\$1.41
CENTRAL					
Logan		Road and			
Menard		building	1,222,893	\$1,799,981	\$1.47
Peoria		Agstone	240,304	431,049	1.79
Operations - 6		All other	—	—	—
		Total	1,463,197	\$2,231,030	\$1.52
EAST SOUTHEAST					
Clark	Douglas	Road and			
Clay	Fayette	building	1,069,059	\$1,986,698	\$1.86
Coles	Marion	Agstone	392,906	748,945	1.91
Cumberland		All other	—	—	—
Operations - 10		Total	1,461,965	\$2,735,643	\$1.87
SOUTHEAST					
Hardin		Road and			
Jefferson		building	1,197,241	\$1,717,747	\$1.43
Massac		Agstone	236,297	322,637	1.37
Operations - 9		All other	—	—	—
		Total	1,433,538	\$2,040,384	\$1.42
STATE TOTALS					
Counties - 60		Road and			
Operations - 227		building	37,857,988	\$52,198,151	\$1.38
		Agstone	3,864,073	5,962,505	1.54
		All other	3,114,895	4,955,689	1.59
		Total	44,836,956	\$63,116,345	\$1.41

^aBased on U. S. Bureau of Mines figures. All values at the quarry.

^bDimension stone and stone used for cement and lime not included.

^cSummary of commercial stone production. Figure 3 shows regions and counties.

MINERAL PRODUCTION IN ILLINOIS IN 1967

TABLE 11 - ILLINOIS COMMON SAND PRODUCTION BY REGIONS, 1967^a

Producing counties and operations ^b	Sand use	Tons	Value	Average per ton	
NORTHWEST					
Bureau	Ogle				
Carroll	Rock Island	Paving	1,662,000	\$1,229,000	\$0.74
Henry	Stephenson	Building	992,000	810,000	0.88
Jo Daviess	Whiteside	All other	1,439,000	778,000	0.54
Lee	Winnebago				
Operations - 26	Total	4,023,000	\$2,817,000	\$0.70	
WEST					
Adams					
Brown		Paving	103,000	\$ 72,000	\$0.70
Fulton		Building	85,000	86,000	1.01
Henderson		All other	61,000	44,000	0.72
Schuyler					
Operations - 10	Total	249,000	\$ 202,000	\$0.81	
WEST SOUTHWEST					
Bond		Paving	168,000	\$ 145,000	\$0.86
Madison		Building	485,000	458,000	0.94
Pike		All other	75,000	49,000	0.65
Sangamon					
Operations - 8	Total	728,000	\$ 652,000	\$0.90	
SOUTHWEST					
Alexander					
Jackson		Paving	72,000	\$ 68,000	\$0.94
Randolph		Building	286,000	279,000	0.98
St. Clair		All other	38,000	33,000	0.87
Union					
Operations - 5	Total	396,000	\$ 380,000	\$0.96	
CENTRAL					
Logan	Mason	Paving	734,000	\$ 575,000	\$0.78
McLean	Peoria	Building	640,000	642,000	1.00
Macon	Tazewell	All other	242,000	210,000	0.87
Marshall	Woodford				
Operations - 21	Total	1,616,000	\$1,427,000	\$0.88	
NORTHEAST					
Cook	Kendall				
DeKalb	Lake	Paving	2,937,000	\$2,734,000	\$0.93
DuPage	LaSalle	Building	3,407,000	3,172,000	0.93
Grundy	McHenry	All other	563,000	342,000	0.61
Kane	Will				
Operations - 50	Total	6,907,000	\$6,248,000	\$0.90	
EAST					
Champaign					
Ford		Paving	268,000	\$ 259,000	\$0.97
Kankakee		Building	269,000	250,000	0.93
Livingston		All other	64,000	34,000	0.53
Vermilion					
Operations - 11	Total	601,000	\$ 543,000	\$0.90	
EAST SOUTHEAST					
Clark	Effingham	Paving	381,000	\$ 319,000	\$0.84
Coles	Fayette	Building	179,000	139,000	0.78
Crawford	Lawrence	All other	40,000	22,000	0.55
Cumberland	Shelby				
Operations - 16	Total	600,000	\$ 480,000	\$0.80	
SOUTHEAST					
Gallatin		Paving	72,000	\$ 76,000	\$1.06
Massac		Building	279,000	290,000	1.04
Wabash		All other	91,000	68,000	0.75
White					
Operations - 9	Total	442,000	\$ 434,000	\$0.98	
STATE TOTALS					
Counties - 59					
Operations - 156	Paving	6,397,000	\$5,477,000	\$0.86	
	Building	6,552,000	6,126,000	0.93	
	All other	2,613,000	1,580,000	0.60	
	Total	15,562,000	\$13,183,000	\$0.85	

^aBased on U. S. Bureau of Mines figures. All values at the pit.

^bSummary of commercial sand production. Figure 3 shows regions and counties.

TABLE 12 - ILLINOIS GRAVEL PRODUCTION BY REGIONS, 1967^a

Producing counties and operations ^b		Gravel use	Tons	Value	Average per ton
NORTHWEST					
Bureau	Putnam				
Carroll	Rock Island	Paving	890,000	\$1,003,000	\$1.13
Henry	Stephenson	Building	597,000	682,000	1.14
Jo Daviess	Whiteside	All other	42,000	28,000	0.67
Lee	Winnebago	Total	1,529,000	\$1,713,000	\$1.12
Ogle					
Operations - 34					
WEST					
Adams					
Brown		Paving	336,000	\$ 485,000	\$1.44
Fulton		Building	—	—	—
Knox		All other	79,000	117,000	1.48
Schuyler		Total	415,000	\$ 602,000	\$1.45
Operations - 8					
WEST SOUTHWEST					
Bond		Paving	118,000	\$ 168,000	\$1.42
Pike		Building	165,000	265,000	1.61
Sangamon		All other	—	—	—
Operations - 6		Total	283,000	\$ 433,000	\$1.53
SOUTHWEST					
Union ^c		Paving	—	\$ —	\$ —
Operations - 2		Building	—	—	—
		All other	—	—	—
		Total	—	\$ —	\$ —
CENTRAL					
DeWitt	Marshall	Paving	1,924,000	\$2,261,000	\$1.18
Logan	Peoria	Building	467,000	641,000	1.37
McLean	Tazewell	All other	109,000	90,000	0.83
Macon	Woodford	Total	2,500,000	\$2,992,000	\$1.20
Operations - 47					
NORTHEAST					
Boone	Kendall				
Cook	Lake	Paving	6,477,000	\$5,304,000	\$0.82
DeKalb	LaSalle	Building	4,048,000	3,910,000	0.97
DuPage	McHenry	All other	1,068,000	681,000	0.64
Grundy	Will	Total	11,593,000	\$9,895,000	\$0.85
Kane					
Operations - 71					
EAST					
Champaign					
Ford		Paving	419,000	\$ 465,000	\$1.11
Iroquois		Building	57,000	77,000	1.35
Livingston		All other	90,000	32,000	0.36
Vermilion		Total	566,000	\$ 574,000	\$1.01
Operations - 20					
EAST SOUTHEAST					
Clark	Fayette	Paving	615,000	\$ 573,000	\$0.93
Coles	Lawrence	Building	87,000	103,000	1.18
Crawford	Moultrie	All other	161,000	92,000	0.57
Cumberland	Shelby	Total	863,000	\$ 768,000	\$0.89
Operations - 16					
SOUTHEAST					
Gallatin		Paving	144,000	\$ 160,000	\$1.11
Massac		Building	53,000	54,000	1.02
Wabash		All other	—	—	—
White		Total	197,000	\$ 214,000	\$1.09
Operations - 7					
STATE TOTALS					
Counties - 56					
Operations - 211		Paving	10,923,000	\$10,419,000	\$0.95
		Building	5,474,000	5,732,000	1.05
		All other	1,549,000	1,040,000	0.67
		Total	17,946,000	\$17,191,000	\$0.96

^aBased on U. S. Bureau of Mines figures. All values at the pit.

^bSummary of commercial gravel production. Figure 3 shows regions and counties.

^cUnion County combined with Southeast Region.

TABLE 13 - ILLINOIS SILICA SAND PRODUCTION, 1966-1967^a

Silica sand use	1966		1967	
	Tons	Value	Tons	Value
Glass sand	1,745,000	\$ 3,655,000	1,999,000	\$ 4,313,000
Molding sand	1,192,000	3,890,000	1,022,000	3,537,000
Other uses ^b				
Ground silica sand ^{c,d}	916,000	5,600,000	804,000	5,045,000
Total silica sand	3,853,000	\$13,145,000	3,825,000	\$12,895,000

^aBased on U. S. Bureau of Mines figures.

^bBlast, engine, filtration, grinding, oil, other.

^cFor abrasives, ceramics, foundry, filler, chemical.

^dGround silica sand figures not available for publication.

TABLE 14 - PRODUCTION OF ILLINOIS CLAY PRODUCTS, 1966-1967

Clay products reported	1966		1967	
	Amount	Value	Amount	Value
Face brick (number)	176,638,077	\$ 8,539,457	166,412,967	\$ 7,859,959
Common brick (number)	122,136,801	3,563,312	118,463,890	3,567,384
Drain and sewer tile (tons)	173,352	5,884,342	194,540	6,912,873
Lightweight aggregate (tons)	563,357	3,313,043	550,000	3,452,943
Other clay products	—	1,075,528	—	1,063,769
Clay and silica refractories	—	9,766,680	—	7,216,777
Pottery and whiteware	—	22,759,628	—	16,040,937
Total		\$54,901,990		\$46,114,642

TABLE 15 - FLUORSPAR SHIPPED AND CONSUMED, 1960-1967^a

Year	Fluorspar Shipments			Fluorspar consumed in United States ^b	Illinois shipments as percent of U.S. consumption
	United States	Illinois	Illinois as percent of U.S.		
1960	229,782	134,529	58.5	643,759	20.9
1961	197,354	116,908	59.2	687,940	17.0
1962	206,026	132,830	64.5	652,888	20.3
1963	199,948	132,060	66.1	736,350	17.9
1964	217,137	127,454	58.7	831,561	15.3
1965	240,932	159,140	66.1	930,127	17.1
1966	253,068	176,175	69.6	1,065,124	16.5
1967	295,643	210,207	71.1	1,091,158	19.3

^aFluorspar figures, in tons, U. S. Bureau of Mines

^bFluorspar consumed includes domestic and foreign material.

TABLE 16 - ILLINOIS ZINC AND LEAD PRODUCTION, 1960-1967^a

Year ^b	Zinc			Lead		
	Tons	Value	Average per ton	Tons	Value	Average per ton
1960	29,550	\$7,623,900	\$258.00	3,000	\$702,000	\$234.00
1961	26,795	6,162,850	230.00	3,430	706,580	206.00
1962	27,413	6,304,990	230.00	3,610	664,240	184.00
1963	20,337	4,677,510	230.00	2,901	626,616	216.00
1964	13,800	3,753,600	272.00	2,180	571,160	262.00
1965	18,314	5,347,688	292.00	3,005	937,560	312.00
1966	15,192	4,405,680	290.00	2,285	690,756	302.00
1967	20,416	5,652,374	277.00	2,384	667,520	280.00

^aBased on U. S. Bureau of Mines figures.

^bMine production of recoverable metal.

TABLE 17 - Continued

Counties	Cement	Clay products	Coal	Crude oil	Fluorspar	Lead	Lime	Natural bonded molding sand	Common sand	Common gravel	Silica sand	Stone	Tripoli	Zinc
Rock Island	—	—	—	—	—	—	—	2	7	27	—	6	—	—
St. Clair	—	20	4	—	—	—	—	—	22	—	—	4	—	—
Saline	—	—	10	14	—	—	—	—	—	—	—	—	—	—
Sangamon	—	12	—	26	—	—	—	—	13	22	—	—	—	—
Schuyler	—	—	—	—	—	—	—	—	52	47	—	57	—	—
Scott	—	19	—	—	—	—	—	—	—	—	—	49	—	—
Shelby	—	—	—	31	—	—	—	—	30	42	—	—	—	—
Stark	—	—	16	—	—	—	—	—	—	—	—	—	—	—
Stephenson	—	—	—	—	—	—	—	—	39	26	—	20	—	—
Tazewell	—	10	—	—	—	—	—	—	11	5	—	—	—	—
Union	—	—	—	—	—	—	—	—	57	50	—	12	—	—
Vermilion	—	13	15	—	—	—	—	—	50	23	—	11	—	—
Wabash	—	—	—	9	—	—	—	—	36	34	—	—	—	—
Warren	—	9	—	—	—	—	—	—	—	—	—	35	—	—
Washington	—	—	21	21	—	—	—	—	—	—	—	31	—	—
Wayne	—	—	—	4	—	—	—	—	—	—	—	—	—	—
White	—	—	—	3	—	—	—	—	33	35	—	—	—	—
Whiteside	—	—	—	—	—	—	—	—	37	45	—	36	—	—
Will	—	5	17	—	—	—	—	—	3	3	—	2	—	—
Williamson	—	—	5	32	—	—	—	—	—	—	—	—	—	—
Winnebago	—	—	—	—	—	—	—	—	5	9	—	15	—	—
Woodford	—	—	—	—	—	—	—	—	56	36	—	—	—	—

ILLINOIS STATE GEOLOGICAL SURVEY

Urbana, Illinois

FULL TIME STAFF
October 1, 1968

JOHN C. FRYE, Ph.D., D.Sc., Chief
Hubert E. Risser, Ph.D., Assistant Chief

R. J. Helfinstine, M.S., Administrative Engineer
G. R. Eadie, M.S., E.M., Asst. Administrative Engineer

Velda A. Millard, Fiscal Assistant to the Chief
Helen E. McMorris, Secretary to the Chief

GEOLOGICAL GROUP

Jack A. Simon, M.S., Principal Geologist
M. L. Thompson, Ph.D., Principal Research Geologist

Frances H. Alsterlund, A.B., Research Assistant

COAL

M. E. Hopkins, Ph.D., Geologist and Acting Head
William H. Smith, M.S., Geologist
Kenneth E. Clegg, M.S., Associate Geologist
Heinz H. Damberger, D.Sc., Associate Geologist
Harold J. Gluskoter, Ph.D., Associate Geologist
Russel A. Peppers, Ph.D., Associate Geologist
John A. Bell, Ph.D., Assistant Geologist

GROUND-WATER GEOLOGY AND GEOPHYSICAL EXPLORATION

Robert E. Bergstrom, Ph.D., Geologist and Head
Merlyn B. Buhle, M.S., Geologist
George M. Hughes, Ph.D., Associate Geologist
John P. Kempton, Ph.D., Associate Geologist
Keros Cartwright, M.S., Assistant Geologist
Manoutchehr Heidari, M.S., Assistant Engineer
Paul C. Heigold, M.S., Assistant Geophysicist
Jean I. Larsen, M.A., Assistant Geologist
Murray R. McComas, M.S., Assistant Geologist
Kemal Piskin, M.S., Assistant Geologist
Frank B. Sherman, Jr., M.S., Assistant Geologist
Shirley A. Masters, B.S., Research Assistant
Verena M. Colvin, Technical Assistant
Daniel E. McMeen, B.A., Technical Assistant

STRATIGRAPHY AND AREAL GEOLOGY

H. B. Willman, Ph.D., Geologist and Head
Elwood Atherton, Ph.D., Geologist
T. C. Buschbach, Ph.D., Geologist
Charles Collinson, Ph.D., Geologist
Herbert D. Glass, Ph.D., Geologist
Lois S. Kent, Ph.D., Associate Geologist
Jerry A. Lineback, Ph.D., Associate Geologist
Alan M. Jacobs, Ph.D., Assistant Geologist
Susan R. Avcin, B.A., Research Assistant

OIL AND GAS

Donald C. Bond, Ph.D., Head
Lindell H. Van Dyke, M.S., Geologist
Thomas F. Lawry, B.S., Associate Petrol. Engineer
R. F. Mast, M.S., Associate Petrol. Engineer
Wayne F. Meents, Associate Geological Engineer
Hubert M. Bristol, M.S., Assistant Geologist
Richard H. Howard, M.S., Assistant Geologist
David L. Stevenson, M.S., Assistant Geologist
Jacob Van Den Berg, M.S., Assistant Geologist
Albert L. Meyers, B.S., Research Assistant

ENGINEERING GEOLOGY AND TOPOGRAPHIC MAPPING

W. Calhoun Smith, Ph.D., Geologist in charge
Paul B. DuMontelle, M.S., Assistant Geologist
Patricia M. Moran, B.A., Research Assistant

INDUSTRIAL MINERALS

James C. Bradbury, Ph.D., Geologist and Head
James W. Baxter, Ph.D., Associate Geologist
Richard D. Harvey, Ph.D., Associate Geologist
Norman C. Hester, Ph.D., Assistant Geologist

GEOLOGICAL RECORDS

Vivian Gordon, Head
Hannah Kistler, Supervisory Technical Assistant
Constance Armstrong, Technical Assistant
Connie L. Maske, B.A., Technical Assistant
Elizabeth Speer, Technical Assistant
Bonnie B. Sullivan, Technical Assistant
Rebecca J. Veenstra, Technical Assistant
Margaret J. Weatherhead, Technical Assistant

CLAY RESOURCES AND CLAY MINERAL TECHNOLOGY

W. Arthur White, Ph.D., Geologist and Head
Bruce F. Bohor, Ph.D., Associate Geologist

GEOLOGICAL SAMPLES LIBRARY

Robert W. Frame, Superintendent
J. Stanton Bonwell, Technical Assistant
Eugene W. Meier, Technical Assistant
Linda D. Rentfrow, Clerk-Typist II

CHEMICAL GROUP

Glenn C. Finger, Ph.D., Principal Chemist

Ruth C. Lynge, Technical Assistant

Thelma J. Chapman, B.A., Technical Assistant

COAL CHEMISTRY

G. Robert Yohe, Ph.D., Chemist and Head

PHYSICAL CHEMISTRY

Josephus Thomas, Jr., Ph.D., Chemist and Head
Robert N. Leamson, M.S., Assistant Chemist

CHEMICAL ENGINEERING

H. W. Jackman, M.S.E., Chemical Engineer and Head
R. J. Helfinstine, M.S., Mechanical Engineer
Henry P. Ehrlinger III, M.S., Assoc. Minerals Engineer
Lee D. Arnold, B.S., Assistant Engineer
W. G. ten Kate, M.S., Geol. D., Assistant Mineralogist
Walter E. Cooper, Technical Assistant
Robert M. Fairfield, Technical Assistant
John P. McClellan, Technical Assistant
Edward A. Schaeede, Technical Assistant (on leave)

ORGANIC GEOCHEMISTRY

G. C. Finger, Ph.D., Acting Head
Donald R. Dickerson, Ph.D., Associate Chemist
Richard H. Shiley, M.S., Assistant Chemist
Gilbert L. Tinberg, Technical Assistant

(Chemical Group continued on next page)

CHEMICAL GROUP (Continued)

ANALYTICAL CHEMISTRY

Neil F. Shimp, Ph.D., Chemist and Head
William J. Armon, M.S., Associate Chemist
Charles W. Beeler, M.A., Associate Chemist
Rodney R. Ruch, Ph.D., Associate Chemist
John A. Schleicher, B.S., Associate Chemist
Larry R. Camp, B.S., Assistant Chemist
David B. Heck, B.S., Assistant Chemist

L. R. Henderson, B.S., Assistant Chemist
Stephen M. Kim, B.A., Assistant Chemist
John K. Kuhn, B.S., Assistant Chemist
Ru-tao Kyi, Ph.D., Assistant Chemist
Sharon L. Olson, B.S., Special Research Assistant
Paul E. Gardner, Technical Assistant
George R. James, Technical Assistant

MINERAL ECONOMICS GROUP

Hubert E. Risser, Ph.D., Principal Mineral Economist
W. L. Busch, A.B., Associate Mineral Economist
Robert L. Major, M.S., Assistant Mineral Economist

ADMINISTRATIVE GROUP

George R. Eadie, M.S., E.M., Administrator

EDUCATIONAL EXTENSION

David L. Reinertsen, A.M., Associate Geologist in charge
George M. Wilson, M.S., Geologist
William E. Cote, M.S., Assistant Geologist
Helen S. Johnston, B.S., Technical Assistant
Myrna M. Killey, B.A., Technical Assistant

FINANCIAL OFFICE

Velda A. Millard, in charge
Marjorie J. Hatch, Clerk IV
Virginia C. Smith, B.S., Account Clerk
Pauline Mitchell, Account Clerk

PUBLICATIONS

Betty M. Lynch, B.Ed., Technical Editor
Carol A. Brandt, B.A., Technical Editor
Jane E. Busey, B.S., Assistant Technical Editor
Marie L. Martin, Geologic Draftsman
James R. Gilmer, Asst. Geologic Draftsman
Sandra L. Oncken, B.F.A., Asst. Geologic Draftsman
William Dale Farris, Research Associate
Kathy Sue Billingsley, Technical Assistant
Dorothy H. Scoggin, Technical Assistant
Beulah M. Unfer, Technical Assistant

CLERICAL SERVICES

Nancy J. Hansen, Clerk-Stenographer II
Hazel V. Orr, Clerk-Stenographer II
Mary K. Rosalius, Clerk-Stenographer II
Dorothy M. Spence, Clerk-Stenographer II
Jane C. Washburn, Clerk-Stenographer II
Becky L. Dowds, Clerk-Stenographer I
Magdelline E. Hutchison, Clerk-Stenographer I
Edna M. Yeargin, Clerk-Stenographer I
Sharon K. Zindars, Clerk-Stenographer I
Shirley L. Weatherford, Key Punch Operator II
Pauline F. Tate, Clerk-Typist II
JoAnn L. Hayn, Clerk-Typist I

GENERAL SCIENTIFIC INFORMATION

Peggy H. Schroeder, B.A., Research Assistant
Florence J. Partenheimer, Technical Assistant

TECHNICAL RECORDS

Berenice Reed, Supervisory Technical Assistant
Miriam Hatch, Technical Assistant
Hester L. Nesmith, B.S., Technical Assistant

SPECIAL TECHNICAL SERVICES

Glenn G. Poor, Research Associate (on leave)
Merle Ridgley, Research Associate
Wayne W. Nofftz, Supervisory Technical Assistant
Donovon M. Watkins, Technical Assistant
Mary M. Sullivan, Supervisory Technical Assistant
David B. Cooley, Technical Assistant

LIBRARY

Lieselotte F. Haak, Geological Librarian (on leave)
Ann M. Sokan, M.A., Acting Geol. Librarian
Jo Ann Boeke, Technical Assistant

EMERITI

M. M. Leighton, Ph.D., D.Sc., Chief, Emeritus
J. S. Machin, Ph.D., Principal Chemist, Emeritus
O. W. Rees, Ph.D., Prin. Research Chemist, Emeritus
W. H. Voskuil, Ph.D., Prin. Mineral Economist, Emeritus
G. H. Cady, Ph.D., Senior Geologist, Emeritus
A. H. Bell, Ph.D., Geologist, Emeritus
George E. Ekblaw, Ph.D., Geologist, Emeritus
J. E. Lamar, B.S., Geologist, Emeritus
R. J. Piersol, Ph.D., Physicist, Emeritus
L. D. McVicker, B.S., Chemist, Emeritus
Enid Townley, M.S., Geologist, Emerita
Lester L. Whiting, M.S., Geologist, Emeritus
Juanita Witters, M.S., Physicist, Emerita
B. J. Greenwood, B.S., Mechanical Engineer, Emeritus

RESEARCH AFFILIATES AND CONSULTANTS

Richard C. Anderson, Ph.D., Augustana College
W. F. Bradley, Ph.D., University of Texas
Donald L. Graf, Ph.D., University of Minnesota
Ralph E. Grim, Ph.D., University of Illinois
S. E. Harris, Jr., Ph.D., Southern Illinois University
Lyle D. McGinnis, Ph.D., Northern Illinois University
I. Edgar Odom, Ph.D., Northern Illinois University
T. K. Searight, Ph.D., Illinois State University
Harold R. Wanless, Ph.D., University of Illinois
George W. White, Ph.D., University of Illinois

Topographic mapping in cooperation with the
United States Geological Survey.

Illinois State Geological Survey Circular 435
24 p., 3 figs., 17 tables, 3500 cop., 1968
Urbana, Illinois 61801

Printed by Authority of State of Illinois, Ch. 127, IRS, Par. 58.25.

ILLINOIS STATE
GEOLOGICAL SURVEY
LIBRARY

CIRCULAR 435

ILLINOIS STATE GEOLOGICAL SURVEY

URBANA